CLAIMS

What is claimed is:

1. A fiber optic module comprising:

one or more electro-optic transducers to convert optical signals into electrical signals or electrical signals into optical signals;

a plurality of module contacts to couple electrical signals to the one or more electro-optic transducers or to receive electrical signals from the one or more electro-optic transducers, the plurality of module contacts to couple electrical signals into a host printed circuit board or to receive electrical signals from the host printed circuit board; and

an elastomer having spaced apart conductors to couple between host contacts electrically coupled to the host printed circuit board and the plurality of module contacts without shorting to each other, the spaced apart conductors to couple electrical signals between the host printed circuit board and the fiber optic module.

2. The fiber optic module of claim 1 wherein,

the elastomer having spaced apart conductors is an interposer or z-connector.

3. The fiber optic module of claim 1 wherein,

the spaced apart conductors of the elastomer are micro-filaments.

4. The fiber optic module of claim 1 wherein,

the spaced apart conductors of the elastomer are metal columns.

5. The fiber optic module of claim 1 further comprising:
a compression stop to avoid over-compression of the elastomer.

6. The fiber optic module of claim 1 further comprising:
a housing to house the one or more electro-optic transducers and the module contacts and provide external access thereto.

7. The fiber optic module of claim 6 wherein,
the housing is shielded to reduce electro-magnetic interference (EMI) generated by the one or more electro-optic transducers or other electronic devices housed therein.

8. The fiber optic module of claim 6 wherein,
the housing has a module retention stop to couple to a latch of a module receptacle of the host printed circuit board and hold the fiber optic module engaged within.

9. The fiber optic module of claim 6 wherein,
the housing has a compression stop to contact a surface to avoid over-compression of the elastomer.

10. The fiber optic module of claim 9 wherein,
the surface is an inner surface of a back-side of a module receptacle of the host printed circuit board.

11. The fiber optic module of claim 9 wherein,
the surface is a top surface of the host printed circuit board.

12. The fiber optic module of claim 1 further comprising:
a means to provide sequential electrical connections during physical insertion of the fiber optic module into a host system.

13. The fiber optic module of claim 12 wherein
the means to provide sequential electrical connections to further provide sequential electrical disconnections during physical removal of the module from a host system.

14. The fiber optic module of claim 12 wherein
the means to provide sequential electrical connections is a ground pin and a power pin.

15. The fiber optic module of claim 12 wherein
the means to provide sequential electrical connections is a ground pad and a power pad.

16. The fiber optic module of claim 15 wherein
the ground pad and the power pad extend beyond signal pads.

17. The fiber optic module of claim 16 wherein
the ground pad and the power pad are thicker than the signal pads.

18. The fiber optic module of claim 15 wherein
the ground pad and the power pad extend beyond signal pads and the ground pad extends beyond the power pad in order to make a ground connection prior to a power connection.

19. The fiber optic module of claim 1 wherein,

the elastomer is compressible to couple between the host contacts and the module contacts.

20. The fiber optic module of claim 19 wherein,
the host contacts are mechanically and electrically coupled to the host printed circuit board.

21. The fiber optic module of claim 19 wherein,
the host contacts are part of an electrical connector, the electrical connector mechanically and electrically coupled to the host printed circuit board.

22. The fiber optic module of claim 19 wherein,
the spaced apart conductors are compressible.

23. The fiber optic module of claim 6 wherein,
the housing has a release lever with a catch to couple to a latch of a module receptacle of the host printed circuit board and to retain the fiber optic module therein.

24. A fiber optic module comprising:
means for converting optical signals into electrical signals or electrical signals into optical signals;
means for coupling electrical signals into and out of the means for converting optical signals into electrical signals; and
a compression means having spaced apart conductors to couple between the means for coupling electrical signals into and out of the means for converting optical signals into electrical signals and a means for coupling electrical signals into and out of a host printed circuit board, the plurality of spaced apart conductors spaced apart to avoid shorting to each other.

25. The fiber optic module of claim 24 wherein the means for converting optical signals into electrical signals is one or more electro-optic transducers.

26. The fiber optic module of claim 24 further comprising: a means for providing sequential electrical connections during physical insertion of the fiber optic module into a host system.

27. The fiber optic module of claim 26 wherein the means for providing sequential electrical connections provides for sequential electrical disconnection during physical removal of the fiber optic module from the host system.

28. The fiber optic module of claim 26 wherein the means for providing sequential electrical connections is a power pin and a ground pin.

29. The fiber optic module of claim 26 wherein the means to provide sequential electrical connections is a ground pad and a power pad.

30. The fiber optic module of claim 24 wherein the compression means is an interposer having an anisotropic electrically conductive elastomer filled with conductive particles or micro-filaments.

31. The fiber optic module of claim 24 wherein the compression means is an interposer having an anisotropic electrically conductive elastomer filled with conductive columns.

32. The fiber optic module of claim 31 wherein the conductive columns are metal columns.

33. The fiber optic module of claim 24 wherein, the spaced apart conductors of the compression means are compressible.

34. A fiber optic module comprising:

one or more optoelectronic devices to convert electrical signals into optical signals or to convert optical signals into electrical signals or both;

a first guide slot to receive a first guide tab of a receptacle and to guide the fiber optic module into the receptacle; and

a first stop slot integral with the first guide slot, the first stop slot to receive the first guide tab and to stop further insertion of the fiber optic module into the receptacle.

35. The fiber optic module of claim 34 wherein the first guide tab is engaged with the first stop slot by a force of a spring in the receptacle.

36. The fiber optic module of claim 34 further comprising:

one or more contact pads to electrically couple to the one or more optoelectronic devices,

an elastomer including spaced apart conductors, the elastomer to compress and to electrically couple between the one or more contact pads of the fiber optic module and one or more contact pads of a host printed circuit board.

37. The fiber optic module of claim 36 wherein

the elastomer is compressed and the first guide tab is engaged with the first stop slot by a force of a spring in the receptacle.

38. The fiber optic module of claim 36 wherein the spaced apart conductors are conductive columns.

39. The fiber optic module of claim 36 wherein the spaced apart conductors are metal columns.

40. The fiber optic module of claim 36 wherein the spaced apart conductors are micro-filaments.

41. The fiber optic module of claim 36 wherein the spaced apart conductors are conductive particles.

42. The fiber optic module of claim 34 further comprising:
a compression stop to prevent over-compression of the elastomer.

43. The fiber optic module of claim 34 wherein the first guide slot and first stop slot are in first side of the fiber optic module,
and the fiber optic module further comprises:
a second guide slot to receive a second guide tab of the receptacle and to guide the fiber optic module into the receptacle;
a second stop slot integral with the second guide slot, the second stop slot to receive the second guide tab and to stop further insertion of the fiber optic module into the receptacle; and,
wherein the second guide slot and the second stop slot are

in a second side of the fiber optic module opposite the first side.

44. The fiber optic module of claim 43 further comprising:

one or more contact pads to electrically couple to the one or more optoelectronic devices,

an elastomer including compressible spaced apart conductors, the elastomer to compress and to electrically couple between the one or more contact pads of the fiber optic module and one or more contact pads of a host printed circuit board.

45. The fiber optic module of claim 44 further comprising:

a compression stop to prevent over-compression of the elastomer.

46. A fiber optic module comprising:

one or more optoelectronic devices to convert electrical signals into optical signals or to convert optical signals into electrical signals or both;

a housing to house the one or more optoelectronic devices, the housing including a first guide tab and a second guide tab;

the first guide tab to engage a first slot of a receptacle and to guide the fiber optic module into the receptacle; and

the second guide tab to engage a second slot of the receptacle and to guide the fiber optic module into the receptacle.

47. The fiber optic module of claim 46 wherein

the first guide tab to further engage a first stop slot in the receptacle by a force of a spring in the receptacle.

48. The fiber optic module of claim 47 wherein

the first stop slot to stop further insertion of the fiber optic module into the receptacle.

49. The fiber optic module of claim 47 further comprising:

one or more contact pads to electrically couple to the one or more optoelectronic devices,

an elastomer including spaced apart conductors, the elastomer to compress and to electrically couple between the one or more contact pads of the fiber optic module and one or more contact pads of a host printed circuit board.

50. The fiber optic module of claim 49 wherein

the first stop slot to allow compression of the elastomer and electrical coupling between the one or more contact pads of the fiber optic module and the one or more contact pads of the host printed circuit board.

51. The fiber optic module of claim 49 further comprising:

a power pin extending beyond the one or more contact pads; and

a ground pin extending beyond the power pin and the one or more contact pads,

the power pin and ground pin to couple to a power socket and a ground socket to provide sequencing of electrical connections for hot pluggability.

52. The fiber optic module of claim 47 further comprising:

one or more contact pads to electrically couple to the one or more optoelectronic devices,

an elastomer including spaced apart conductors, the elastomer to compress and to electrically couple between the one or more contact pads of the fiber optic module and one or more

contact pads of an electrical connector coupled to a host printed circuit board.

53. The fiber optic module of claim 52 further comprising:

a power pin extending beyond the one or more contact pads; and

a ground pin extending beyond the power pin and the one or more contact pads,

the power pin and ground pin to couple to a power socket and a ground socket of the electrical connector to provide sequencing of electrical connections for hot pluggability.

54. A fiber optic module comprising:

a housing;

one or more opto-electronic devices in the housing to convert between optical signals and electrical signals;

a plurality of signal contacts to couple electrical signals to the one or more opto-electronic devices or to receive electrical signals from the one or more opto-electronic devices;

an elastomer having spaced apart conductors to couple to the plurality of module contacts; and

a retention stop coupled to the housing, the retention stop to couple to a latch of a module receptacle to retain the fiber optic module therein.

55. The fiber optic module of claim 54 wherein,

the elastomer having spaced apart conductors is an interposer.

56. The fiber optic module of claim 54 wherein,

the spaced apart conductors of the elastomer are micro-filaments.

57. The fiber optic module of claim 54 wherein,
the spaced apart conductors of the elastomer are metal columns.

58. The fiber optic module of claim 54 further comprising:
a compression stop to avoid over-compression of the elastomer.

59. The fiber optic module of claim 54 wherein
the housing provides external access to the plurality of module contacts.

60. The fiber optic module of claim 54 wherein,
the housing is shielded to reduce electro-magnetic interference (EMI).

61. The fiber optic module of claim 54 further comprising:
a power contact extending beyond the plurality of signal contacts; and
a ground contact extending beyond the power contact and the plurality of signal contacts,
the power contact and ground contact to make a power and ground electrical connection prior to making a signal electrical connection to provide sequencing of electrical connections for hot pluggability.

62. The fiber optic module of claim 61 further comprising:
the power contact and the ground contact are pins and the plurality of signal contacts are a plurality of pads.

63. The fiber optic module of claim 61 further comprising:

the power contact and the ground contact are pads and the plurality of signal contacts are a plurality of pads.

64. The fiber optic module of claim 54 further comprising:

at least one release lever having a catch to engage an opening in at least one latch of the module receptacle.

65. A fiber optic module cage comprising:

a guide rail to receive a guide tab of a fiber optic module and guide the fiber optic module into the fiber optic module cage;

a cage stop integral with the guide rail to receive the guide tab and to stop further insertion of the fiber optic module;

a spring to force the fiber optic module down into the cage stop.

66. The fiber optic module cage of claim 65 further comprising:

a housing to couple to the spring and to encompass the guide rail, the housing to couple to ground to provide shielding of electromagnetic radiation.

67. The fiber optic module cage of claim 65 wherein

the spring to further cause contacts of the fiber optic module to electrically couple to contacts of a host printed circuit board through an elastomer connector.

68. The fiber optic module cage of claim 65 further comprising

an electrical connector having a ground socket and a power socket to receive a ground pin and a power pin respectively of

the fiber optic module.

69. The fiber optic module cage of claim 65 further comprising:

an electrical connector having electrical contact pads to electrically couple to contacts of the fiber optic module through an elastomer connector.

70. The fiber optic module cage of claim 69 wherein

the elastomer connector is an interposer.

71. The fiber optic module cage of claim 69 wherein

the electrical connector further has a ground socket and a power socket to receive a ground pin and a power pin respectively of the fiber optic module.

72. The fiber optic module cage of claim 65 further comprising:

a latch to couple to a retention stop of the fiber optic module.

73. The fiber optic module cage of claim 65 wherein

the fiber optic module cage couples to a host printed circuit board, the host printed circuit board having electrical contact pads located within the perimeter of the fiber optic module cage to electrically couple to a fiber optic module.

74. A retention mechanism for fiber optic modules, the retention mechanism comprising:

a spring arm having a first end, a second end and a middle region, the spring arm to retain a fiber optic module, the spring arm further having,

a spring latch at a second end of the spring arm, the spring latch to allow insertion of a fiber optic module and to engage a retention stop of the fiber optic module, and

the first end of the spring arm to be in a fixed position with respect to a host printed circuit board.

75. The retention mechanism of claim 74 wherein the spring latch has a sloped leading edge to allow insertion of the fiber optic module and to engage the retention stop of the fiber optic module.

76. The retention mechanism of claim 74 wherein the first end to couple to the host printed circuit board to be in the fixed position with respect to the host printed circuit board.

77. The retention mechanism of claim 74 wherein the first end to couple to an electrical connector, the electrical connector to couple to the host printed circuit board such that the first end of the spring arm to be in the fixed position with respect to the host printed circuit board.

78. The retention mechanism of claim 74 wherein the middle region provides a lever arm to apply force to the spring latch to engage the retention stop of the fiber optic module.

79. The retention mechanism of claim 74 wherein a length of the middle region of the spring arm to retain the fiber optic module in an electrical coupling with an electrical connector coupled to the host printed circuit board. the spring to further cause contacts of the fiber optic module to

electrically couple to contacts of a host printed circuit board through an elastomer connector.

80. The retention mechanism of claim 79 wherein the spring arm to further cause contacts of the fiber optic module to electrically couple to contacts of the electrical connector through an elastomer connector.

81. The retention mechanism of claim 79 wherein, the electrical connector has a ground socket and a power socket to receive a ground pin and a power pin respectively of the fiber optic module.

82. The retention mechanism of claim 79 wherein, the electrical connector has electrical contact pads to electrically couple to contact pads of the fiber optic module through an elastomer connector.

83. The retention mechanism of claim 82 wherein the elastomer connector is an interposer.

84. The retention mechanism of claim 74 further comprising: a guide rail to receive a guide tab of the fiber optic module and to guide the fiber optic module into the retention mechanism.

85. The retention mechanism of claim 84 further comprising: a cage stop integral with the guide rail to receive the guide tab and to stop further insertion of the fiber optic module.

86. A retention system for fiber optic modules, the

retention system comprising:

a pair of moveable guide rails each having a slot to engage a guide tab of a fiber optic module; and

a lever system to move the moveable guide rails to adjust a distance between the moveable guide rails and a host printed circuit board, the lever system including

pivot arms each having a first end to rotatably couple to an end of the moveable guide rails and a second end to rotatably couple to a side of a cage, and

a lever arm having a first end and a cam, the first end of the lever arm to rotatably couple to a side of the cage, the cam to mechanically couple to the moveable guide rails to move the moveable guide rails in response to movement of the lever arm.

87. The retention system of claim 86 wherein

the cam of the lever arm has an arc shaped opening to slideably couple to a pivot point of one of the pivot arms.

88. The retention system of claim 86 wherein

the moveable guide rails are a pair of guide rails mechanically coupled together.

89. The retention system of claim 86 wherein

a pair of the pivot arms of the lever system are mechanically coupled together.

90. The retention system of claim 86 wherein

at least one of the pair of moveable guide rails includes a cage stop integral with the guide rail to receive the guide tab and to stop further insertion of the fiber optic module.

91. A host system for fiber optic modules, the host system comprising:

a housing to couple to a host printed circuit board;

a pair of moveable guide rails each having a slot to engage a guide tab of a fiber optic module;

pivot arms each having a first end to rotatably couple to an end of the moveable guide rails and a second end to rotatably couple to a side of the housing; and

a spring coupled to a top of the housing, the spring to apply a force to a top of the fiber optic module to move the moveable guide rails and adjust a distance between the moveable guide rails and the host printed circuit board.

disclosed on PA but not shown in Fig 7A no regions of no latch

92. The host system of claim 91 wherein

the housing is a conductive cage to couple to a ground of the host printed circuit board and reduce electromagnetic interference (EMI).

93. A method of making electrical connections for a fiber optic module, the method comprising:

inserting the fiber optic module having module contacts and an elastomer into a cage;

applying a force to the fiber optic module to compress the elastomer and form electrical connections; and

stopping the compression of the elastomer.

94. The method of claim 93 wherein

the elastomer having spaced apart conductors to couple between the module contacts and host contacts of a host printed circuit board without shorting to each other, the spaced apart conductors to couple electrical signals between the host printed

circuit board and the fiber optic module.

95. The method of claim 93 wherein
prior to applying the force, the method further comprises,
making a ground electrical connection; and
making a power electrical connection, the ground and power electrical connection to provide hot pluggability.

96. The method of claim 93 further comprising
retaining the fiber optic module in position to maintain compression of the elastomer and the electrical connections.

97. A method of engaging a fiber optic module into a host system, the method comprising:
engaging a guide tab of the fiber optic module with a guide rail;
sliding the guide tab along the guide rail;
engaging the guide tab into a stop of the guide rail; and
applying a force to the fiber optic module to maintain the guide tab in the stop.

98. The method of claim 97 further comprising:
coupling a catch of a release lever into an opening of a latch.

99. The method of claim 97 further comprising:
compressing an elastomer between module contacts of the fiber optic module and host contacts.

100. The method of claim 99 wherein
the host contacts are coupled to a host printed circuit board.

101. The method of claim 99 wherein the host contacts are part of an electrical connector coupled to a host printed circuit board.

102. A method of engaging a fiber optic module into a host system, the method comprising:

engaging a pair of guide tabs of the fiber optic module with a pair of guide rails;

sliding the guide tabs along the guide rails;

moving the guide rails and the fiber optic module closer to a plane of a host printed circuit board; and

compressing an elastomer between module contacts of the fiber optic module and host contacts of the host printed circuit board.

103. The method of claim 102 wherein the moving of the guide rails is by a lever.

104. The method of claim 102 wherein the moving of the guide rails is by a spring.

105. A system comprising:

a fiber optic module to engage a module receptacle, the fiber optic module including

an optical connector,

one or more optoelectronic devices to convert between optical signals and electrical signals,

a housing to cover the one or more optoelectronic devices, and

a guide tab coupled to the side of the housing; and

the module receptacle including

a cage to couple to a host printed circuit board,

a guide rail to receive the guide tab of the fiber optic module,

and

a spring coupled to a top of the cage, the spring to apply a force to a top of the housing of the fiber optic module.

106. The system of claim 105 wherein

the fiber optic module further includes

one or more module contacts, and

an elastomer;

the module receptacle further includes

an electrical connector having one or more host contacts;

and

the spring to apply sufficient force to the top of the housing of the fiber optic module to compress the elastomer and form electrical connections between the one or more module contacts and the one or more host contacts.

107. The system of claim 106 wherein

the one or more module contacts and the one or more host contacts are pads.

108. The system of claim 106 wherein

the fiber optic module further includes

a ground contact and a power contact extending beyond the one or more module contacts;

and

the module receptacle further includes

a ground contact and a power contact to make an

electrical connection with the ground contact and power contact of the fiber optic module prior to the one or more module contacts making electrical connections with the one or more host contacts.

109. The system of claim 108 wherein
the one or more module contacts, the one or more host contacts, the ground contact and the power contact of the module receptacle, and the ground contact and power contact of the fiber optic module are pads.

110. The system of claim 108 wherein
the one or more module contacts and the one or more host contacts are pads,
the ground contact and the power contact of the module receptacle are sockets, and
the ground contact and power contact of the fiber optic module are pins.

111. A system comprising:
a fiber optic module including
an optical connector,
one or more optoelectronic devices to convert between optical signals and electrical signals,
a housing to cover the one or more optoelectronic devices, and
a retention stop coupled to the housing;
an electrical connector to couple to a host printed circuit board;
and
a retention mechanism to couple to the electrical connector at one end, the retention mechanism having a spring latch at an opposite end to couple to the retention stop of the fiber optic

module.

112. The system of claim 111 wherein
the fiber optic module further includes
one or more module contacts, and
an elastomer having space apart conductors, the elastomer being compressible;
and the electrical connector further has one or more host contacts to make electrical connections with the one or more module contacts through the elastomer.

113. The system of claim 112 wherein
the one or more module contacts and the one or more host contacts are pads.

114. The system of claim 11 wherein
the fiber optic module further includes
a ground contact and a power contact extending beyond the one or more module contacts;
and
the electrical connector further includes
a ground contact and a power contact to make an electrical connection with the ground contact and power contact of the fiber optic module prior to the one or more module contacts making electrical connections with the one or more host contacts.

115. The system of claim 112 wherein
the fiber optic module further includes
a compression stop to avoid over compression of the elastomer.

116. The system of claim 111 further comprising:
one or more guide rails to guide the fiber optic module toward the electrical connector and to engage the retention mechanism.

117. The system of claim 116 wherein
the fiber optic module further includes
one or more guide tabs to engage the one or more guide rails.

118. The system of claim 111 wherein
the fiber optic module further includes
one or more release levers, each of the one or more release levers including a catch;
and the system further comprises
one or more latches, each of the one or more latches having an opening to respectively receive the catch of the one or more release levers.

119. An integrated cage comprising:
a front portion having a frontal opening without a door, the frontal opening to receive a fiber optic module;
a pair of sides each having a guide to guide the fiber optic module into the integrated cage;
a top shield to deter electromagnetic radiation from leaking out the frontal opening;
and wherein the front portion, the pair of sides, and the top shield are integrally molded together as one piece.

120. The integrated cage of claim 119 wherein
the guide in each of the pair of sides is a guide rail

extending out from each side to engage a slot in each side of the fiber optic module.

121. The integrated cage of claim 119 wherein the guide in each of the pair of sides is a guide slot extending into each side of the integrated cage to engage a tab in each side of the fiber optic module.

122. The integrated cage of claim 119 wherein each of the front portion, the pair of sides, and the top shield are formed of metal.

123. The integrated cage of claim 119 wherein each of the front portion, the pair of sides, and the top shield are formed of metallized plastic.

124. A cage comprising:

a pair of sides each having a guide to guide the fiber optic module into the cage;

a front portion having a frontal opening, the front portion coupled to the pair of sides, the frontal opening to receive a fiber optic module;

a pair of rotatable flaps each having a hinge;

a pair of cylindrical pins each having a pair of ends, each end of the pair of cylindrical pins to couple to respective sides of the pair of sides of the cage, the pair of cylindrical pins to rotatably engage the hinges of the pair of rotatable flaps; and

a pair of springs coupled to the pair of rotatable flaps respectively, the pair of springs to force the pair of rotatable flaps into a closed position to close the frontal opening.

125. The cage of claim 124 wherein

the guide in each of the pair of sides is a guide rail extending out from each side to engage a slot in each side of the fiber optic module.

126. The cage of claim 124 wherein
the guide in each of the pair of sides is a guide slot extending into each side of the integrated cage to engage a tab in each side of the fiber optic module.

127. The cage of claim 124 wherein
each of the front portion, the pair of sides, and the pair of flaps are formed of metal.

128. The cage of claim 124 wherein
each of the front portion, the pair of sides, and the pair of flaps are formed of metallized plastic.

129. The cage of claim 124 wherein
each of the pair of flaps rotates to an open position when a fiber optic module is inserted into the cage and rotates to a closed position to seal the frontal opening when the fiber optic module is removed from the cage.

130. The cage of claim 124 further comprising:
a top shield coupled to each of the pair of sides and the frontal portion of the cage.